NONLINEAR SEISMIC IMAGING, INC.

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TAWASSUL A. KHAN
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SENT VIA FACSIMILE 703/872-9318

September 18, 2002

Toan M. Le, Examiner
Box PATENT APPLICATION
Commissioner for Patents
Washington, DC 20231

RE: ***Application No. 09/853,190***
Applicant Tawassul A. Khan (Inventor)
Titled - Mapping Permeable Reservoir Formations by Measuring the Elastic Nonlinear Interactions of a Seismic Wave as it Propagates through the Reservoir Rock Matrix and its Pore Fluids.

Dear Mr. Le:

Enclosed is the Reply to USPTO Office Action Summary of July 31, 2002 regarding Application No. 09/853,190.

The write-up has been submitted for the intent of making the patent clearer and the claims have been rewritten and modified to be more specific and to remove any ambiguity of these claims by taking out any 'general' terms. Please reconsider the revised claims; we believe we have reduced any uncertainty due to the generic nature of our previously written claims.

Further, we are resubmitting and rewriting the original claim 9 for consideration. This election to resubmit all 9 claims supersedes the provisional election made by Sofia McGuire on July 23, 2002.

Thank you for your consideration in this matter. Please do not hesitate to contact me at 713/942-7926 with any questions.

Sincerely,

Sofia McGuire

REPLY TO USPTO OFFICE ACTION SUMMARY OF JULY 31, 2002;
RE: APPLICATION NO. 09/853,190

Election/Restrictions

The applicant resubmits the original claim 9 for consideration as a species of the claim that is being submitted. The original claims 1-9 are clarified as follows in italics:

A new method for determining in-situ bulk tortuosity of the interconnected pores of reservoir rock, and estimating the bulk permeability of a reservoir formation between seismic transmitters and seismic receivers, such method comprising 1-7 below:

1. *Transmit a monofrequency signal generated by a seismic transmitter or seismic transmitters and received by a seismic receiver or seismic receivers.*

2. *Analyze the spectral content of the received signal.*

3. *Identify the side lobes of the monofrequency signal that was transmitted.*

4. *The frequency of the side lobes represents (F - Fdrag) and (F + Fdrag) where F is the monofrequency and Fdrag is the frequency of the 'Drag Wave'. These side lobes are generated due to the elastic nonlinear interaction between the monofrequency wave traveling through the rock matrix and the 'Drag Wave' being generated due to the coupling between the matrix and pore fluids.*

5. *Calculate the velocity of the 'Drag Wave' Vdrag by using the Doppler Effect in which Fdrag/F = Vdrag/(V – Vdrag); where Fdrag is the frequency of the 'Drag Wave' (see 4 above), F is the monofrequency, Vdrag is the velocity of the 'Drag Wave' and V is the velocity of the monofrequency signal.*

6. *The bulk tortuosity of the inter-well reservoir rock formation can be estimated by: Vdrag = Vfluid/$\sqrt{T}$, where Vdrag is the velocity of the 'Drag Wave', T is tortuosity, and Vfluid is the compressional velocity of the pore fluids.*

7. *Once bulk tortuosity has been estimated, bulk permeability can be estimated using Scheidegger's equation $K = \varphi r^2 / 8T$ or other equations generated by Kelder or Peeters.*

8. *The method of claims 1-7 specifically used to determine in-situ bulk tortuosity of the interconnected pores of reservoir rock, and estimating the bulk permeability of a reservoir formation connected between two wells.*

9. *The method of claims 1-7 specifically used to determine in-situ bulk tortuosity of the interconnected pores of reservoir rock, and estimating the bulk permeability of a reservoir formation in a well between two depth points in that well.*

GAU 2862

PTO/SB/21 (08-00)
Approved for use through 10/31/2002. OMB 0651-0031
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

Application Number	09/853,190
Filing Date	5-11-01
First Named Inventor	Tawassul A. Khan
Group Art Unit	2862
Examiner Name	Toan M. Le
Attorney Docket Number	

Total Number of Pages in This Submission: 13

ENCLOSURES *(check all that apply)*

- ☐ Fee Transmittal Form
  - ☐ Fee Attached
- ☑ Amendment / Reply
  - ☐ After Final
  - ☐ Affidavits/declaration(s)
- ☐ Extension of Time Request
- ☐ Express Abandonment Request
- ☐ Information Disclosure Statement
- ☐ Certified Copy of Priority Document(s)
- ☐ Response to Missing Parts/ Incomplete Application
  - ☐ Response to Missing Parts under 37 CFR 1.52 or 1.53
- ☐ Assignment Papers *(for an Application)*
- ☐ Drawing(s)
- ☐ Licensing-related Papers
- ☐ Petition
- ☐ Petition to Convert to a Provisional Application
- ☐ Power of Attorney, Revocation Change of Correspondence Address
- ☐ Terminal Disclaimer
- ☐ Request for Refund
- ☐ CD, Number of CD(s) _____
- ☐ After Allowance Communication to Group
- ☐ Appeal Communication to Board of Appeals and Interferences
- ☐ Appeal Communication to Group *(Appeal Notice, Brief, Reply Brief)*
- ☐ Proprietary Information
- ☐ Status Letter
- ☑ Other Enclosure(s) *(please identify below)*: Revised Claims Response to Office Action Summary

Remarks: Please read enclosed letter.

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm or Individual name	Sofia McGuire, Vice President, Nonlinear Seismic Imaging, Inc.
Signature	
Date	9-20-02

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, Washington, DC 20231 on this date: 9-20-02

Typed or printed name	Sofia K. McGuire		
Signature		Date	9-20-02